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ABSTRACT

This paper discusses cognitive and noncognitive variables, and their relationship with each other, in learning and in educational evaluation. The nature of noncognitive learning environment variables is examined. The following instruments that have been widely used in assessing classroom environment are described: (1) the Learning Environment Inventory (LEI); (2) the Classroom Environment Scale; and (3) My Class Inventory. The description lists the instruments, the levels at which these instruments have been and can be used, the number of items in each scale, and the classification of the scales. A model for assessing the validity of the instruments is developed. The psychometric adequacy and the construct validity of the LEI is examined in the context of cognitive and noncognitive variables. It argues that the use and the interpretation of the instruments should be considered in conjunction with contextual constraints such as demographic variables, motivation for use, the individual and group styles for responding, and experience with the instrument. (JAZ)

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# Self-Report Measures of Learning Climate/Environment: Some Alternative Validation Strategies

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Running Head: VALIDITY OF LEARNING ENVIRONMENT MEASURES

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## Abstract

The role of cognitive and noncognitive measures in educational practice is reviewed. It is argued that both types of variables have a complex and intricate relationship with each other. Further, a specific role of the classroom climate or environment in education is considered and a model for assessing the validity of the learning environment measures is developed. In this case, it is argued that the context of other variables must be kept in mind when presenting validity evidence. Finally, three examples of validity evidence of a learning environment instrument have been presented to illustrate the force of the two arguments.

## Self-Report Measures of Learning Climate/Environment: Some Alternative Validation Strategies

A variety of cognitive measures are used by practitioners and specialists to guide educational practice and to make a variety of instructional and administrative decisions. Cognitive measures of intellectual abilities, knowledge of subject matter, and a number of information processing skills and processes have had a long history of use in educational practice. Because of the fact that cognitive measures are predictive of current and future academic achievement and also that they provide initial diagnostic information for instructional planning and remediation, their use is quite common. These measures could be regarded as aptitudes in the technical sense of current characteristics that predict the capacity to learn (English & English, 1958). Similarly, a number of noncognitive measures, such as motivation, interest, and affect, may also qualify as aptitudes in the technical sense, for they too are predictive of likelihood of success in a given learning environment (Bloom, 1976; Cronbach & Snow, 1977). The noncognitive individual "characteristics share a number of educationally relevant features with cognitive traits beyond sheer predictiveness" (Messick, 1979, p. 281). These common features , according to Messick (1979), are characterized by the following functions of the two variable types:

> For example, they may both serve as mediating or instrumental variables, either facilitative or disruptive,

> influencing level and rate of subject-matter learning; or as moderator or interactive variables determining differential responses, either qualitative or quantitative, to different aspects of instructional method or context; or as outcome variables reflective of educational goals in their own right or of valued personal characteristics that should not be undermined by unintended educational side effects. (p. 281)

Often a distinction is made between cognitive and noncognitive measures. However, when a noncognitive label is used to refer to such personality variables as cognitive style or orientation, motives, and values, it leads to confusion and ambiguity. This is because many personality dimensions and "traits usually involve important cognitive components... and some of the putative noncognitive variables themselves appear to be at least as much cognitive in nature as not" (Messick, 1979, p. 282).

Furthermore, Messick (1979) has identified seven educational functions being served by noncognitive measures, akin to those served by cognitive measures. These are: access, objectives and standards, guidance, selection, placement, instruction and learning, and evaluation and "thus deal, respectively, with the who, what/which, why, whether/where, when/how long, how, and how well of education" (p. 289). Noncognitive variables are characterized to be variously relevant for the seven functions and the pattern of relevance is seen to be different depending on the type of the educational institution or level. All twelve

noncognitive variables identified as appropriate for educational service, namely, experiential background, affects, attitudes/beliefs, interests, motivation, curiosity, temperament, social sensitivity, coping strategies, cognitive styles, creativity, and values, are pervasively useful for instruction and learning and evaluation at all educational levels. However, for other functions, these noncognitive variables are differentially relevant depending on the educational level.

Given this background to the pervasive importance of noncognitive variables for learning and evaluation, the present paper examines the nature of learning environment variables. Specifically, this paper examines the structure of the Learning Environment Inventory (LEI) (Anderson, 1971; Fraser, Anderson, & Walberg, 1982), when used as a generalized measure, in the context of achievement measures and other noncognitive measures. In this regard, the psychometric adequacy and construct validity of the LEI, which, according to Messick (1979), is the evidential basis for its use in educational evaluation and in the assessment of instructional and learning adequacy, will be examined. Though, one must also appraise the consequential aspect of its use, which is the consideration of the value implications of the proposed application, but for this instrument that aspect of validation has not yet been completed. However, from the reports of school psychologists and teachers and administrators, the use of such measures in our province does not have as serious consequences as the use of cognitive measures. Hence, it appears

that educational merit of individuals and institutions is determined more by the relative standing on cognitive measures than on the noncognitive measures. This may partly be due to the fact that educators are well versed with the implementation and use of cognitive resources, materials, and strategies and processes but not with the noncognitive repertoire.

Classroom Environment Instruments

The aim of this section is to provide a brief description of the available instruments for assessing the classroom environment. This description lists the instruments, gives the levels at which these instruments have been and can be used, number of items in each scale, and the classification of scales according to Moos's (1973) conceptual dimensions.

Three instruments that have been widely used for research and evaluation are listed in Table 1. The Learning Environment Inventory (LEI) (Anderson, 1971; Fraser, Anderson, & Walberg, 1982), the Classroom Environment Scale (CES) (Moos & Trickett, 1974), and the My Class Inventory (MCI) (Anderson, 1971; Fraser, Anderson, & Walberg, 1982) have been used extensively in several countries. The first two of these instruments have been used

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Insert Table 1 about here.

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primarily at the junior high and high school levels whereas the MCI has been frequently employed at the elementary school level. A large volume of research and evaluation work, involving these

instruments, has been reported. It is not the purpose of this paper to review this research here. However, for those interested, an extensive summary of this research is available in a recently published book (Fraser, 1986).

Scales of the three instruments have been classified in Table 1 as reported in Fraser (1986) and supposedly according to Moos´s (1973) conceptualization of human environments. Moos´s scheme for viewing environments covered a variety of settings and thus provides a general organizing structure. To group a number of scales according to a general conceptual scheme is one thing, but when the behavior of these scales is judged in a particular application it may be another matter. Randhawa and Hunt (1976) reported results of factor analysis for grades 11 and 8 classes and found that the scales of the LEI and the Primary Mental Abilities Test (PMA) produced three well differentiated (LEI and PMA specific) factors for grade 11 classes but not for grade 8 classes. The grouping of the scales of the LEI for grade 11 was: Cohesiveness, Diversity, Formality, Speed, Friction, Favoritism, Difficulty, Cliqueness, Satisfaction, Disorganization, and Competitiveness on Factor I and Formality, Environment, Friction, Goal Direction, Favoritism, Apathy, and Democratic on Factor II. As can be seen Formality, Friction, and Favoritism turned out to be complex variables, these loaded on both the LEI factors. The three factors for the grade 8 data, not only had scales loading on two of the LEI factors but also on the PMA factor. This

illustrates the need for validity studies in the context of theoretical conceptions and of a variety of situations.

Moos's (1973) three conceptual dimensions are: Relationship, Personal Development, and System Maintenance and Change. The relationship dimension involves the nature and intensity of personal relationships within an environment and with this one can assess the extent to which individuals are participating in the environment and are supportive and helpful to each other. The personal development dimension enables us to assess the basic directions of personal growth and self-actualization. However, system maintenance and change dimension yields information on the quality of order, expectations, control, and responsiveness of the environment.

Moos (1974a, 1974b, 1975, 1976, 1979) has shown that the same three conceptual dimensions are appropriate in characterizing diverse psychosocial environments. Moos has been able to demonstrate the emergence of these dimensions in his research involving classrooms, university residences, hospital wards, community-based treatment centers, juvenile and adult correctional institutions, military companies, families, social and therapy groups, and work situations. The commonality of these dimensions among such varied contexts apparently led Moos to assert that it is desirable that any instrument designed for assessing human environments ensures the coverage of these dimensions. Hence, a prescription for the domain specification of instruments for measuring human environments has been

formulated, at least from one theoretical perspective. The underlying claim for justification seems to be the convergence of evidence based on instruments developed in the first place to include these three dimensions. Therefore, the classification of the LEI and MCI scales post facto would not necessarily yield the convergence Moos obtained from his data collected in a variety of environmental contexts. The LEI and MCI were based on the personal constructs conceptualization of Murray (1938). Therefore, a lack of fit of the LEI and MCI scales with the Moos"s conceptual scheme is not only expected but is also necessary if the two theoretical conceptions have any inherent distinctions.

Validity Issues In the Measurement of Environments

Anastasi (1986), in the prefatory chapter of the 37th volume of the Annual Review of Psychology, traces the evolution of test validity and validation, a concept and a procedure, respectively. She states:

> Almost any information gathered in the process of developing or using a test is relevant to its validity. It is relevant in the sense that it contributes to our understanding of what a test measures. Certainly, data on internal consistency and on retest reliability help to define the homogeneity of the construct and its temporal stability. Norms may well provide additional construct specification, especially if they include separate normative data for subgroups classified by age, sex, or other demographic

variables that affect test performance. (p. 3)

This is certainly the case with instruments for measuring the psychosocial environments. These instruments were usually designed after considering theoretical, practical, and daily life situations. It is the information that was accumulated with the use of such instruments that provided the much needed validity information. Data such as internal consistency, item characteristics, and stability information were generally available at the outset. However, factorial alignments of various scales in these instruments, differences for demographic categories, and other inferential data became available long after these instruments were made available for use in research and evaluation applications.

Even if all the needed validity information were available before an instrument is put into circulation, any new and different information adds to the meaning of the test scores. "Test validity is a living thing; it is not dead and embalmed when the test is released" (Anastasi, 1986, p. 4). Validation process of a test is a continuing and never-ending one. Messick (1980) argued persuasively that "different kinds of inferences from test scores require different kinds of evidence, not different kinds of validity ... Validity is the overall degree of justification for test interpretation and test use" (p. 1014). This interpretive meaningfulness of a test, according to Messick, is referred to as <u>construct validity</u>.

It is becoming clear, therefore, that a model of test validation incorporating evidential and consequential bases along one dimension and the interpretive and utility functions along the other, comprising a fourfold table, as proposed by Messick (1980), is appropriate for the validation of instruments for assessing classroom environments, as long as the interpretation and use of the instrument is considered in conjunction with the contextual constraints. The contextual constraints involve the demographic variables, motivation for use, the individual and group styles and orientations for reponding to the instrument, experience with the instrument, and so on.

Validity Evidence

In this section an example of the validity evidence on the LEI is presented. This is done in terms of the use of the LEI by me and my collaborators. A comprehensive summary of the evidence on this instrument is provided by Fraser (1986).

We first used the LEI in 1972 on a representative sample of 46 grade 8 and 50 grade 11 classrooms in Saskatchewan. The selected classes in each grade were representative both of classes in mathematics, science, social studies, and English and in rural and urban locales. One half of the students in each class took the LEI and the other half took the PMA. Means of the scales in both the instruments were computed and these data were analyzed separately for each grade. With the grade 11 orthogonally rotated principal components as the target, the three components of the grade 8 data were maximally rotated to

make the two sets of matrices as similar as possible. These results were reported by Randhawa and Hunt (1976). As mentioned earlier, grade 11 factors were differentiated in the sense that two of the factors represented the LEI scales and the third factor was exclusively defined by the PMA scales. On the other hand, the grade 8 factors were undifferentiated, the PMA or the intellectual climate factor had significant loadings of a few of the LEI scales. This finding prompted us to conclude that "the prevalent cognitive structure of a group plays a concomitant role in social interaction and that the influence of cognitive structure in social interaction decreases as a function of grade level" (p. 548). This conclusion is consistent with Messick's (1979) assertion:

> The cognitive, affective, and other subsystems of personality have differentiable properties, to be sure, but they are manifold and complex and intricately intertwined. They may be sorted into dichotomous classes only at the price of confusion and mischief. (p. 282)

With the above challenge in mind, we proceeded to examine the LEI in the context of cognitive and nocognitive measures. Specifically, our interest was to determine the amount of redundant variance in various pairs of data sets and thus to determine the extent of differential construct validity of the LEI with cognitive and noncognitive measures. This study is briefly described here.

During the 1985-86 academic year, 15 rural and 15 urban grade 7 classrooms were selected. Vocabulary (V), Reading (R), Spelling (S), Capitalization (C), Punctuation (P), Usage (U), Mathematics Concepts (MC), Mathematics Problems (MP), and Mathematics Computation (MCN) tests, of the Canadian Tests of Basic Skills (CTBS), Form 5, Level 13 (King, 1982), were administered in the Fall 1985. Shortly after, the students in these classes took the LEI and completed a questionnaire which elicited demographic, homework, television viewing hours, and attitudinal information. The teachers of these students completed one composite questionnaire, Florida Key (Purkey, Cage, & Graves, 1973), on behalf of each student. This instrument provides measures on a student's coping, asserting, investing, and relating behaviors in the classroom.

A canonical correlation analysis of the 15 LEI scales as one set of variables and the nine CTBS test scores as another set of variables produced one significant canonical correlation ($R_c$ = .83, $p \leq .05$). The LEI set of variables accounted for 33.4% of the redundant variance in the CTBS set. However, the CTBS set of variables accounted for only 6.6% of the redundant variance in the LEI set. This result shows that the redundant relationship between the two sets of variables is asymmetric. But, if one examined only the $R_c^2$, it could have been erroneously concluded, as it has been with many of the validation studies, that the LEI set predicted 68% of the variance in the CTBS set, the cognitive variables.

In the second canonical correlation analysis, the LEI scales as a set were related with 13 other noncognitive measures, including the four FK scales, four attitudinal scales, homework completion, class cooperation, class management, class attentitiveness, and study skills. Two significant ($p \leq .05$) canonical correlations, .95 and .90, respectively, were obtained. Corresponding to these two correlations together, the LEI set of variables produced a total redundant variance of 15.7% in the other noncognitive set of variables. Whereas, the noncognitive set of variables accounted for 20.1% of redundant variance in the LEI set. In terms of the redundancy coefficients for these two sets of variables, it appears that these variables nevertheless have symmetric relationship.

In the third canonical correlation analysis, the LEI set was related to the nine CTBS variables, used in the first analysis, together with the 13 noncognitive variables, used in the second analysis. Two significant canonical correlations, .97 and .95, respectively, were obtained. The redundant variance accounted for by one set in the other set, by virtue of the two significant correlations, was approximately the same, 19%. This finding is an example of the best case for a symmetric relationship.

These three examples of validity evidence demonstrate the fact that the quality and quantity of evidence depends on the context of the variables used in producing the evidence. Also, these results provide another piece of evidence that cognitive and noncognitive measures are intricately related.

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Table 1

Description of Some Learning Environment/Climate Instruments[a]

| Instrument | Level Appropriate | Items Per Scale | Scales by Moos's Conceptual Scheme | | |
|---|---|---|---|---|---|
| | | | Relationship | Personal Development | System Maintenance and Change |
| Learning Environment Inventory (LEI) | Junior and Senior High School | 7 | Cohesiveness<br>Friction<br>Favoritism<br>Cliqueness<br>Apathy | Speed<br>Difficulty<br>Competitiveness | Diversity<br>Formality<br>Environment<br>Goal Direction<br>Disorganization<br>Democracy |
| My Class Inventory (MCI) | Elementary School | 6-9 | Cohesiveness<br>Friction<br>Satisfaction | Difficulty<br>Competitiveness | |
| Classroom Environment Scale | Junior and Senior High | 10 | Involvement<br>Affiliation<br>Teacher Support | Task Orientation<br>Competition | Order and Organization<br>Role Clarity<br>Teacher Control<br>Innovation |

[a]Adapted from Fraser (1986, p. 15)